



XFT Monitoring + Error Rates

Alison Lister

Robin Erbacher, Rob Forrest, Andrew Ivanov, Aron Soha



Monitoring: TrigMon

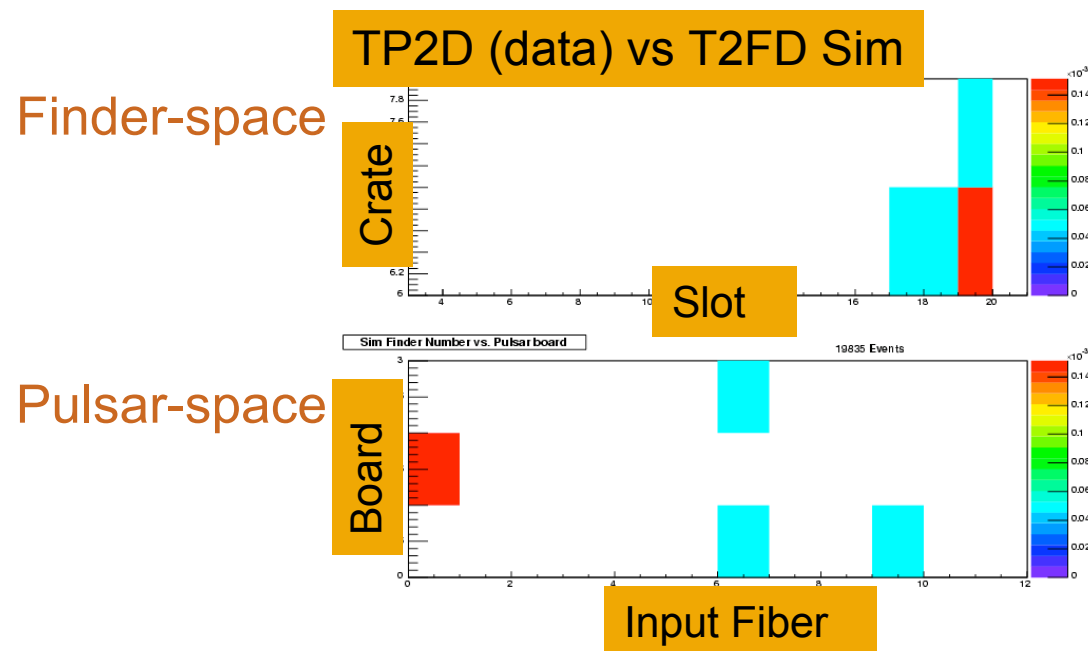
Timeline of TrigMon releases for XFT L2

- 8th January: First official XFT L2 version of TrigMon running in Control room
 - Basic bank comparisons between data and data or simulation as well as data integrity checks (e.g. bunch counters) at each stage: Finders, Pulsars
- 3rd March: Updated monitoring
 - Better checks for errors in bank comparisons
- 16th April: Latest version running
 - Includes timing information for various components of the system
 - Includes better diagnostics for the “out-of-sync” problems
 - Includes plot for CO (but not in checklist yet)
- Further update will probably be required to finalise the checks, add canvas colour when bad, solve minor bugs
 - To be done once all hardware is finalised



Monitoring: Hardware

- TrigMon code looks at bank comparisons at different stages
 - XSFD (L1 path in Finders)
 - T2FD (L2 path in Finders)
 - TP2D (Pulsar bank)
 - XSFD Sim where the simulation starts from the XTCD bank
 - T2FD Sim where the simulation starts from the XTCD bank



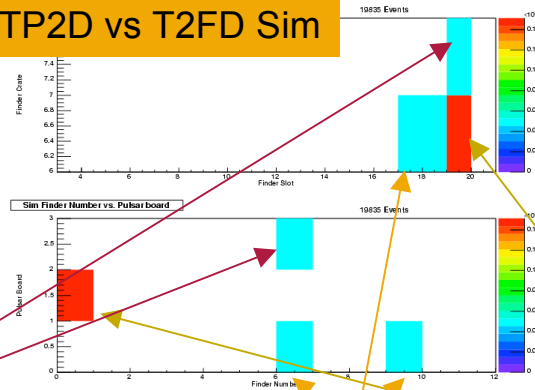
CO plot:
Summary of all
errors in whole
system
Other plots used to
diagnose what the
problem is



Monitoring: Hardware

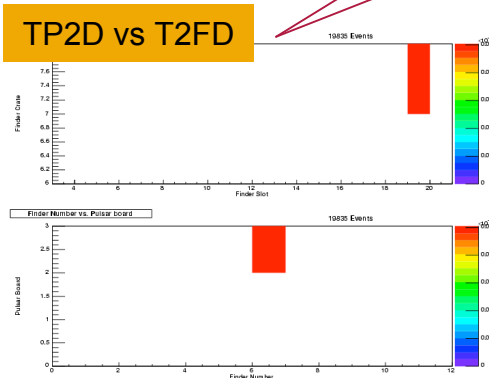
Run 243521
Lumi 240-95e30
Error rate:
Max 3 errors / finder /
20'000 events

TP2D vs T2FD Sim



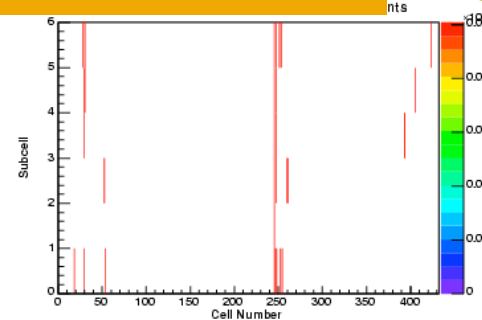
Expert canvases
used to diagnose
problem

TP2D vs T2FD

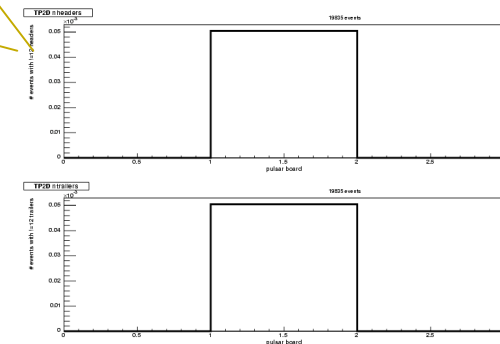


1 event with
T2FD error
Bunch Counter
mismatches

XSFD vs XSFD Sim: SL7



2 event with
XSFD error

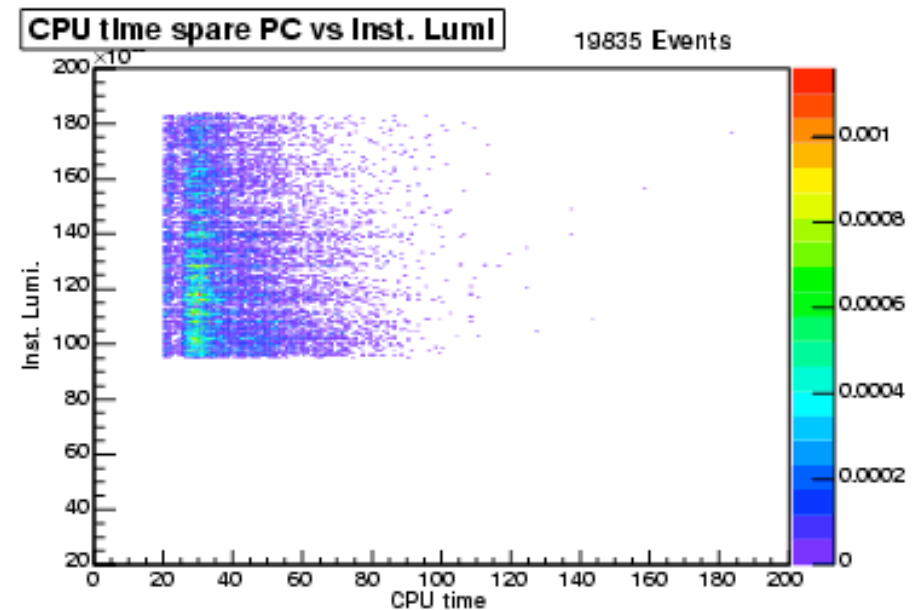


3 events where
TP2D bank
structure is corrupt
(!= 12 finders in
XFT01)



Monitoring: Timing

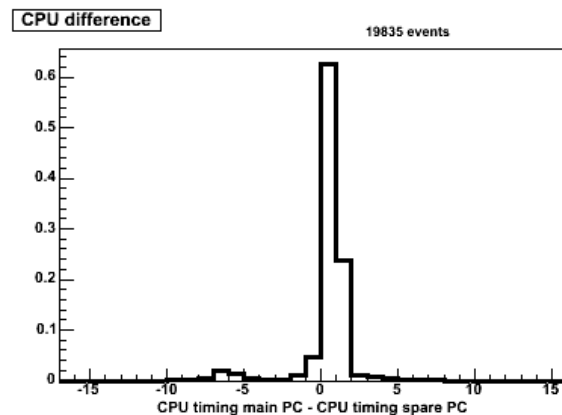
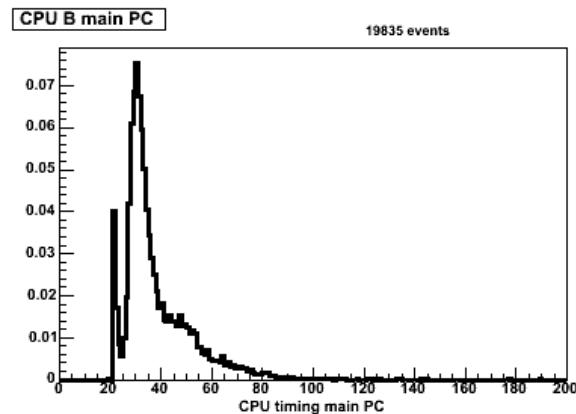
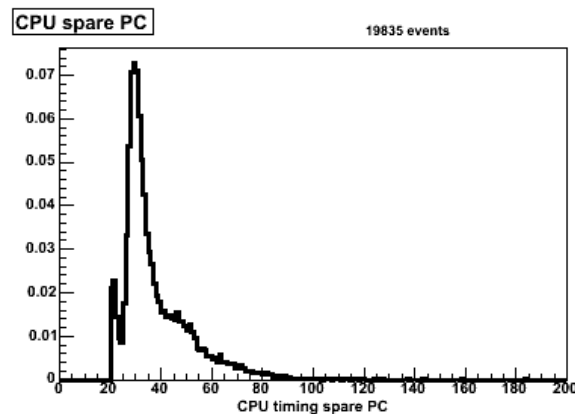
- Timing information needed for commissioning and debugging of system (“expert only” plots)
- Timing information is available for most components of the system
 - Arrival time for each finder packet to the Pulsar
 - Available only when DATA I/O enabled
 - CPU timing
 - Main one used for tests
 - L2TS Signal out to TS
 - Signal back from TS
 - Unpacking of different inputs
 - TL2D: Algorithm timing





Monitoring: Timing

- Lots of work put in by L2XFT-team to reduce timing delays in new PC
- CPU Timing for parasitic PC with XFT (no algos) vs “old” PC



Most events new PC ~1us faster than old one

For SVT fast abort ~6us slower

Findings independent of which inputs are being read out

i.e. same for L2CAL only and XFT+L2CAL



Error Rates

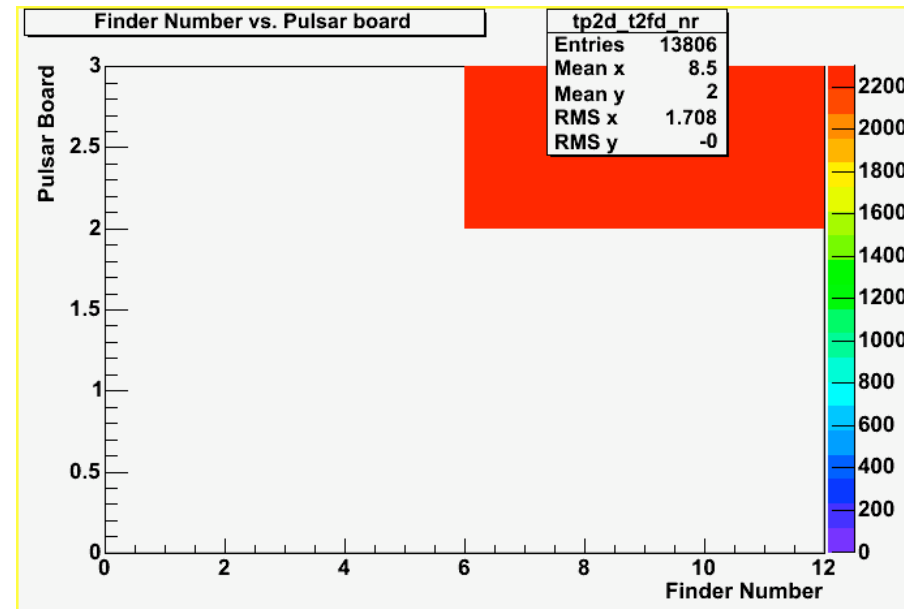
- When no obvious hardware problems are present (“SEU”) rate
 - $\sim 3 \cdot 10^{-4}$ to have an error somewhere in the system
 - $\sim 8 \cdot 10^{-6}$ to have an error in a given “finder” package
 - $\sim 1/4$ of them are related to problems upstream (also seen in L1)
 - These problems don’t cause “operational” problems with L2 PC (e.g. data corrupt for 3 errors in a row that causes an HRR)
 - Could affect outcome of trigger decision for single events
 - Additional ~ 1 -2 errors per 10’000 events where the bunch counters for the first finders in each crate have a bunch counter mismatch (off by 1)
 - Data agrees with simulation so not an operational problem
- Hardware failures
 - “out-of-sync” problem from March- April
 - Finder problem with L2 (data corrupt)



“Out of Sync” Problem

March-April problem:

- Rate ~once per store on average
- 1 chip in a Pulsar board gets out of sync wrt other chip and rest of event
- Stays out of sync until an HRR is issued
 - HRR now issued from parasitic PC after 3 consecutive problems
- Not related to pulsar board
- Problem solved after swapping input fibers
- Think that 1 of the SL3 fibers might be slightly flakey
- In current configuration the problem hasn't returned for ~2 months





Finder L2 Problem

- Problem occurs when 1 finder contains corrupted data
- L1 path agrees with simulation
- L2 path does not agree with L1
- Causes operational problems (L2TO) as data gets out of sync (i.e. corrupted data in PC) and stays out of sync until problem is solved or XTC is masked on
- Seen in TrigMon plots (e.g T2FD vs XSFD)
- Happened once before in December when not running parasitically
 - Related to the finder board
 - Masking on XTC stopped the problem
 - Swapped out the boards but was never investigated further
- Happened again end of May (?)
 - Masking on XTCs allowed us to keep taking data
 - Unmasked XTCs to narrow down problem and problem did not re-appear
 - “Flakey” problem :-)
- Rate seems to be once every ~5 months



Conclusions

- Monitoring of all stages has been running in TrigMon for almost 6 months
- Still minor code changes to be implemented for “final” version
- Error rate for “normal” data taking is manageable
- Diagnostic tools for hardware failures have shown to be useful in quickly finding and solving problems



Backup



Finder L2 Problem

My personal suggestion for “what to do if this problem happens again”

- Diagnostics
 - Many L2TO causing data to no longer be taken
 - L2 will be paged
 - TrigMon plots should show some sign of which Finder is cause
 - Not necessarily the case as TrigMon only runs on selected trigger path and if no data is being taken won't appear recorded data..
 - L2 PC logfile should show which XFT Pulsar is corrupted
 - Dump Pulsar banks to narrow it down to 1 finder
 - XFT should be paged
- Solving the problem
 - Trial and error of masking on XTCs (as can't mask all of them at once) until problem goes away
- Need to understand where the problem is
 - Problem needs to happen again before can investigate further
 - If finder hardware problem we will need help diagnosing
- Current statistics tell us this might happen every ~ 5 months